

**LISTING OF CLAIMS:**

1 – 17. (Cancelled)

18. (Previously presented) A superconductor integrated circuit comprising:

a base electrode layer;

a tunnel barrier layer disposed above the base electrode layer, the tunnel barrier layer having a lateral surface portion;

a counter electrode layer disposed above the tunnel barrier layer; and

an anodization ring disposed around a perimeter of the counter electrode layer and a perimeter of the tunnel barrier layer for preventing a short-circuit between an outside contact and the base electrode layer,

wherein:

a tunnel junction region is defined by the counter electrode layer, the tunnel barrier layer and the base electrode layer, the tunnel junction region including a junction contact defined by a top surface of the counter electrode, the junction contact having a diameter of approximately 1.00  $\mu\text{m}$  or less; and

the anodization ring includes an anodized portion of the counter electrode layer, an anodized portion of the lateral surface portion of the tunnel barrier layer and an anodized portion of the base electrode layer.

19. (Original) The superconductor integrated circuit of claim 18, wherein the base electrode includes an electrode isolation region disposed approximately 0.8  $\mu\text{m}$  or less in horizontal distance from the junction contact for providing device isolation.

20. (Original) The superconductor integrated circuit of claim 18, further comprising a patterned oxide layer disposed above the base electrode layer and the anodization ring for defining an outside contact via and a base electrode via, wherein a surface area of the outside contact via is greater than a surface area of the junction contact.

21. (Original) The superconductor integrated circuit of claim 20, further comprising a wire layer disposed above the oxide layer for providing an outside contact and a base electrode contact, wherein a surface area of the outside contact is greater than a surface area of the junction contact.

22. (Original) The superconductor integrated circuit of claim 18, wherein the counter electrode layer is disposed solely within the anodization ring.

23. (Canceled)

24. (Original) The superconductor integrated circuit of claim 18, wherein the tunnel barrier layer is disposed solely within the anodization ring.

25. (Original) The superconductor integrated circuit of claim 18, wherein:  
the base electrode layer and the counter electrode layer are comprised of niobium;  
the tunnel barrier layer is comprised of a layer of aluminum and a layer of  $\text{Al}_2\text{O}_3$  disposed above the layer of aluminum; and  
the anodization ring is comprised of  $\text{Al}_2\text{O}_3$  and  $\text{Nb}_2\text{O}_5$ .

26. (Previously presented) The superconductor integrated circuit of claim 18, wherein the anodized portion of the counter electrode layer extends upwardly around the perimeter of the counter electrode layer from the anodized portion of the tunnel barrier layer and the anodized portion of the base electrode layer, an associated diameter of the anodized portion of the counter electrode layer being less than an associated diameter of the anodized portion of the tunnel barrier layer and the anodized portion of the base electrode layer.

27. (Previously presented) A superconductor integrated circuit comprising:  
a base electrode layer;  
a tunnel barrier layer disposed above the base electrode layer;  
a counter electrode portion disposed above an unexposed portion of the tunnel barrier layer; and  
an anodization ring disposed around a perimeter of the counter electrode portion and around the unexposed portion of the tunnel barrier layer for preventing a short-circuit between an outside contact and the base electrode layer, the anodization ring including an anodized portion of the tunnel barrier layer anodized from an exposed portion of the tunnel barrier layer;  
wherein:

a tunnel junction region is defined by the counter electrode layer, the unexposed portion of the tunnel barrier layer and the base electrode layer, the tunnel junction region including a junction contact defined by a top surface of the counter electrode, the junction contact having a diameter of approximately 1.00  $\mu\text{m}$  or less; and

the anodization ring further includes an anodized portion of the counter electrode layer and an anodized portion of the base electrode layer, the anodized portion of the counter electrode layer extending upwardly around the perimeter of the counter electrode layer from the anodized portion of the tunnel barrier layer and the anodized portion of the base electrode layer, an associated diameter of the anodized portion of the counter electrode layer being less than an associated diameter of the anodized portion of the tunnel barrier layer and the anodized portion of the base electrode layer.

28. (Previously presented) A superconductor integrated circuit comprising:

a base electrode layer;

a tunnel barrier layer disposed above the base electrode layer;

a counter electrode portion disposed above an unexposed portion of the tunnel barrier layer; and

an anodization layer formed from at least a portion of the base electrode layer and an exposed lateral surface portion of the tunnel barrier layer and an anodization ring disposed laterally around a perimeter of the counter electrode portion and around the unexposed portion of the tunnel barrier layer for preventing a short-circuit between an outside contact and the base electrode layer,

wherein:

a tunnel junction region is defined by the counter electrode layer, the unexposed portion of the tunnel barrier layer and the base electrode layer, the tunnel junction region including a junction contact defined by a top surface of the counter electrode, the junction contact having a diameter of approximately 1.00  $\mu\text{m}$  or less; and

the anodized portion of the counter electrode layer extends upwardly around the perimeter of the counter electrode layer from the anodized portion of the tunnel barrier layer and the anodized portion of the base electrode layer, an associated diameter of the anodized portion of the counter electrode layer being less than an associated diameter of the anodized portion of the tunnel barrier layer and the anodized portion of the base electrode layer.

29. (Canceled)

30. (Currently amended) A superconductor integrated circuit comprising:

a base electrode layer;

a tunnel barrier layer disposed above the base electrode layer;

a counter electrode layer disposed above the tunnel barrier layer; and

an anodization ring disposed around a perimeter of the counter electrode layer and a perimeter of the tunnel barrier layer for preventing a short-circuit between an outside contact and the base electrode layer,

wherein:

a tunnel junction region is defined by the counter electrode layer, the tunnel barrier layer and the base electrode layer, the tunnel junction region including a junction contact defined by a top surface of the counter electrode, the junction contact having a diameter of approximately 1.00  $\mu\text{m}$  or less; and

the anodization ring includes an anodized portion of the counter electrode layer, an anodized portion of the tunnel barrier layer and an anodized portion of the base electrode layer; and

the anodized portion of the counter electrode layer extends upwardly around the perimeter of the counter electrode layer from the anodized portion of the tunnel barrier layer and the anodized portion of the base electrode layer, an associated diameter of the anodized portion of the counter electrode layer being less than an associated diameter of the anodized portion of the tunnel barrier layer and the anodized portion of the base electrode layer.